



June 11, 2015

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Office Of Engineering And Technology And Wireless Telecommunications Bureau Seek Information On Current Trends In LTE-U And LAA Technology - ET Docket No. 15-105*

Dear Ms. Dortch:

Ruckus Wireless, Inc. ("Ruckus"), a pioneer and leading provider of wireless infrastructure solutions for the service provider and enterprise markets, is happy to provide the following comments in response to the above-captioned information request. At the outset, Ruckus believes that the Commission has an opportunity to set a precedent of preserving the principles of fair use in the unlicensed spectrum by thoroughly evaluating and testing technologies before proprietary solutions are widely implemented that might impair decades of value creation based on those principles.

What are the anticipated technical characteristics (e.g. bandwidth(s), listen-before-talk, transmission durations, etc.) of LTE-U and LAA?

Pre-standard LTE-U implementations employ a duty cycle approach, where the LTE-U transmitting nodes seize the medium for a period of time. During this period, networks that employ listen-before-talk ("LBT") are blocked from using the medium. Ruckus is concerned that because the maximum duration of this period of blockage is not standardized, proprietary and pre-standard LTE-U implementations could have a potentially devastating effect on 802.11-based ("Wi-Fi") networks, especially for services such as voice and video over Wi-Fi.

Also, LTE-U does not specify a standardized medium access control mechanism, such as LBT, that must be implemented prior to a transmitting node seizing the medium. Ruckus is concerned that proprietary and pre-standard LTE-U implementations could disrupt Wi-Fi networks by using an access control mechanism that does not provide fair and equal access to the medium. Wi-Fi stations assume such fair and equal access and it is unclear how effective the existing Wi-Fi queuing and backoff mechanisms will be in an environment where they have no opportunity to access the spectrum for potentially lengthy periods of time during the LTE-U duty cycle.

The 3GPP has yet to define these two technical aspects of LAA for Release 13. Ruckus understands that LAA is likely to include an access control mechanism, which they refer to as Category 4 LBT, which includes adaptive backoff and a contention window that is compatible with the 802.11 specification, and would provide fair and equal access to the medium for LAA and Wi-Fi networks. However, LAA might mandate use of Category 4 LBT only in regions where regulatory rules require it (e.g., Europe and Japan). Were that to be the case, LAA could be

deployed without any form of LBT in some regions (e.g., the United States), potentially causing serious disruption to existing Wi-Fi deployments.

Ruckus considers two other aspects to be critical considerations for successful coexistence between LAA and Wi-Fi networks:

- The LAA specification must include a transmission duration which does not impact voice and video services over Wi-Fi; and
- The design of LAA must consider how to mitigate the hidden node problem, which the 802.11 networks mitigate by use of the RTS / CTS mechanism.

An alternate solution is being developed within 3GPP RAN2 under the Work Item Description RP-150510, "LTE-WLAN Radio Level Integration and Interworking Enhancement," approved for 3GPP RAN in March 2015. This Work Item, often referred to as LWA (LTE / WLAN Aggregation), is targeted for completion in 3GPP Release 13. LWA would provide aggregation and tight integration at the radio level allowing for real-time channel and load aware radio resource management across Wi-Fi and LTE. LWA will achieve the same goal as pre-standard LTE-U and LAA - providing operators with a method to supplement the use of licensed spectrum with unlicensed spectrum - but uses the existing 802.11 specification. If standard 802.11 CSMA/CA mechanisms are implemented, LWA will provide industry-consistent compatibility with existing Wi-Fi deployments. Ruckus is engaged in LWA development and believes that it is likely to be better received by Wi-Fi ecosystem players due to its use of 802.11 at the Physical (PHY) and Medium Access Control (MAC) layers.

What tests or analyses have been performed to understand the impact of LTE-U and LAA on the existing commercial wireless and unlicensed ecosystems?

A large number of simulations have been performed by the member companies of 3GPP RAN1 under the LAA Study Item the results of which will be captured in Technical Report, 36.889. While these simulation results provide interesting and valuable data, the parameters and scenarios used for the simulations vary widely, making it difficult, if not impossible, to draw substantive conclusions from the results. In addition, there are important evaluation metrics which were not considered in 3GPP simulations (including jitter, packet loss, frame re-transmission rate, Beacon loss and deferral, and power save signaling loss and deferral). Ruckus believes that communications to 3GPP RAN1 from the IEEE liaison reflect the concerns that many Wi-Fi ecosystem players have with the simulation assumptions (reference 3GPP documents: RP-140536 "Areas of Mutual Interest to 802 LMSC and 3GPP"; RP-150024 "Liaison Statement Regarding Coexistence of Licensed Assisted Access (LAA) and IEEE 802"; R1-151155 "Liaison Statement Regarding Clarification of LBT Categories" and "Liaison Statement Regarding LAA/802.11 Coexistence"; RP-150566 "LS as follow-up regarding LAA").

The Wi-Fi Alliance (WFA) has formed a working group to study coexistence mechanisms enabling shared use of unlicensed spectrum and to define Wi-Fi network baseline performance evaluation. The group is exploring key aspects of coexistence from a Wi-Fi perspective, including fair and equal access to the medium. Ruckus believes that this work will produce a structured and logical series of simulation and test results, and an analysis on the impact of LAA on Wi-Fi.

As key portions of pre-standard LTE-U remain proprietary, only the implementing vendors can provide test results or analysis that show the impact of LTE-U and LAA on the existing commercial wireless and unlicensed ecosystems. Ruckus believes that, prior to standardization, LTE-U and LAA should be thoroughly tested to demonstrate fair sharing of the unlicensed spectrum in public field trials with open participation from a wider community of user equipment and infrastructure.

Are existing devices capable of software upgrades to implement LTE-U and LAA?

Ruckus Wireless believes existing devices and network infrastructure would not be capable of implementing pre-standard LTE-U and LAA when fully defined through software upgrades only. In contrast, LTE device and infrastructure vendors have indicated that existing LTE devices and network infrastructure might be capable of implementing LWA through software upgrades only. Ruckus is evaluating whether existing Wi-Fi Access Points (APs) could implement LWA through software upgrades.

If you have any questions, please do not hesitate to contact me.

Respectfully submitted,



Steve Martin
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Ruckus Wireless, Inc.